

Ranger: Circumstances, Events, Legacy

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Origins of Ranger and Mariner

- In 1958-59, JPL chooses deep space as its goal
- JPL and ABMA/Von Braun (Army team) begin launch services planning with USAF
- Transfer to new NASA leads to much confusion
- October 1960 Mars window abandoned;
Mariner A becomes Mariner R for Venus 1962
- Ranger allocated five Atlas-Agena vehicles
- DSN and SFOF development started

Ranger and Mariner Philosophy

- Common bus, variable payloads
- Science on every flight (Army legacy)
- Build reliability through repetition (Army)
- Uninterrupted telemetry, find failure cause
- Planetary schedule fixed; drive Ranger hard to gain experience with that
- Soviets expected to compete

Initial Ranger Flight Plan

- Two test flights, high apogee, not aimed at Moon, to demonstrate attitude control, solar power and high-gain communications.
- Particle and field instruments, UV telescope
- Then three lunar rough landers with m/c maneuver hydrazine burn and solid retro
- Seismometer in capsule, Gamma ray spectrometer and TV on bus

Events in 1960 and 1961

- Ranger project established in October 1960
- Soviet Mars launch failures, 10 and 14 Oct.
- Kennedy inaugural address, 20 Jan. 1961
- Soviet Venus launches, 4 and 12 Feb. 1961
- Gagarin orbits Earth, 12 April 1961
- Kennedy announces Apollo, 25 May 1961
- Ranger 1 and 2 launched, 23 August and 18 November 1961

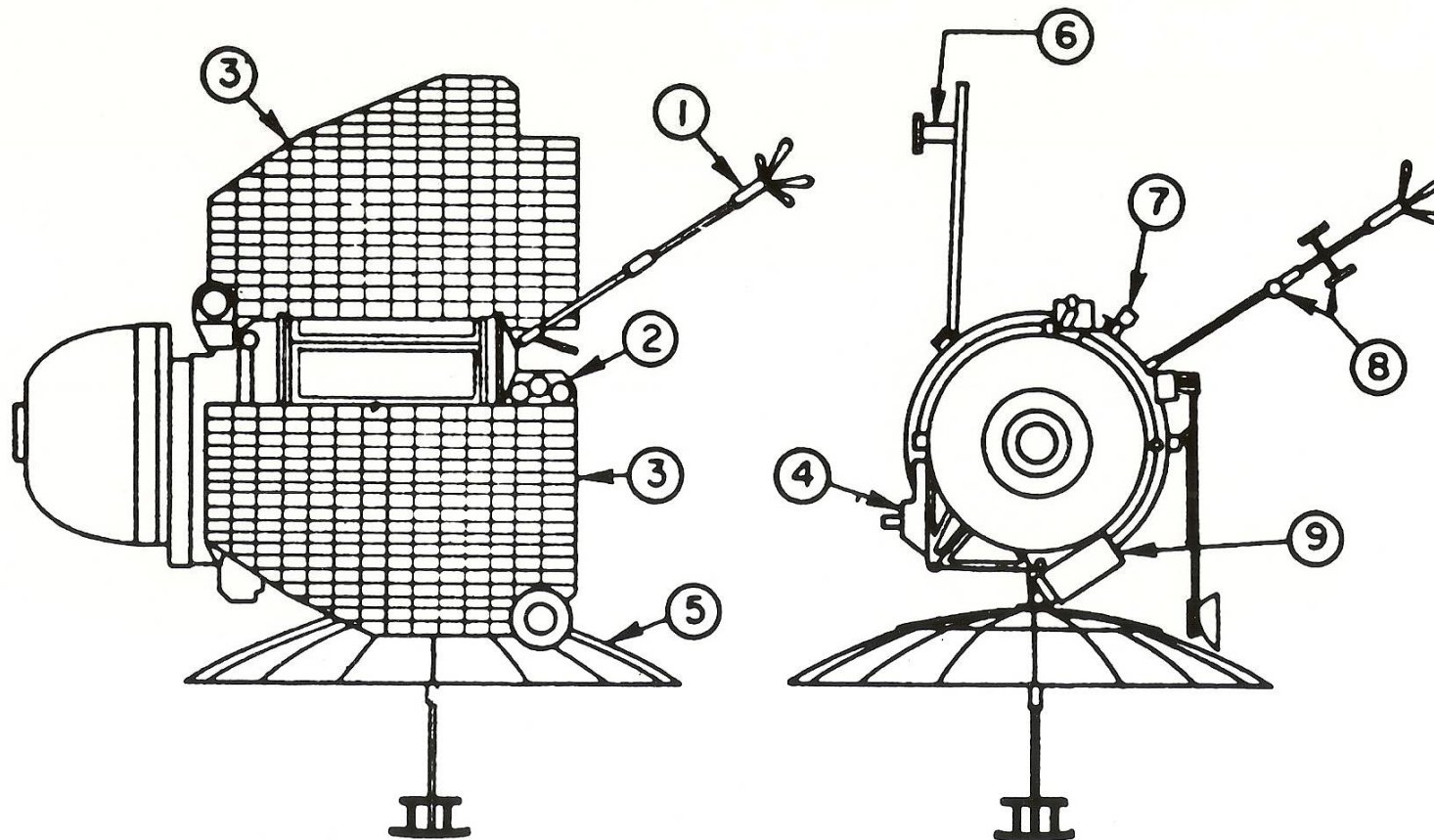


Diagram of Sputnik VIII automatic interplanetary station.

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|---|--------------------------------------|
| (1) Omnidirectional rod antenna. | (6) Medium-range antenna. |
| (2) Heat sensors. | (7) Ion trap. |
| (3) Solar batteries. | (8) Magnetometer elements. |
| (4) Sun and star orientation sensor. | (9) Earth orientation sensor. |
| (5) Parabolic antenna. | |

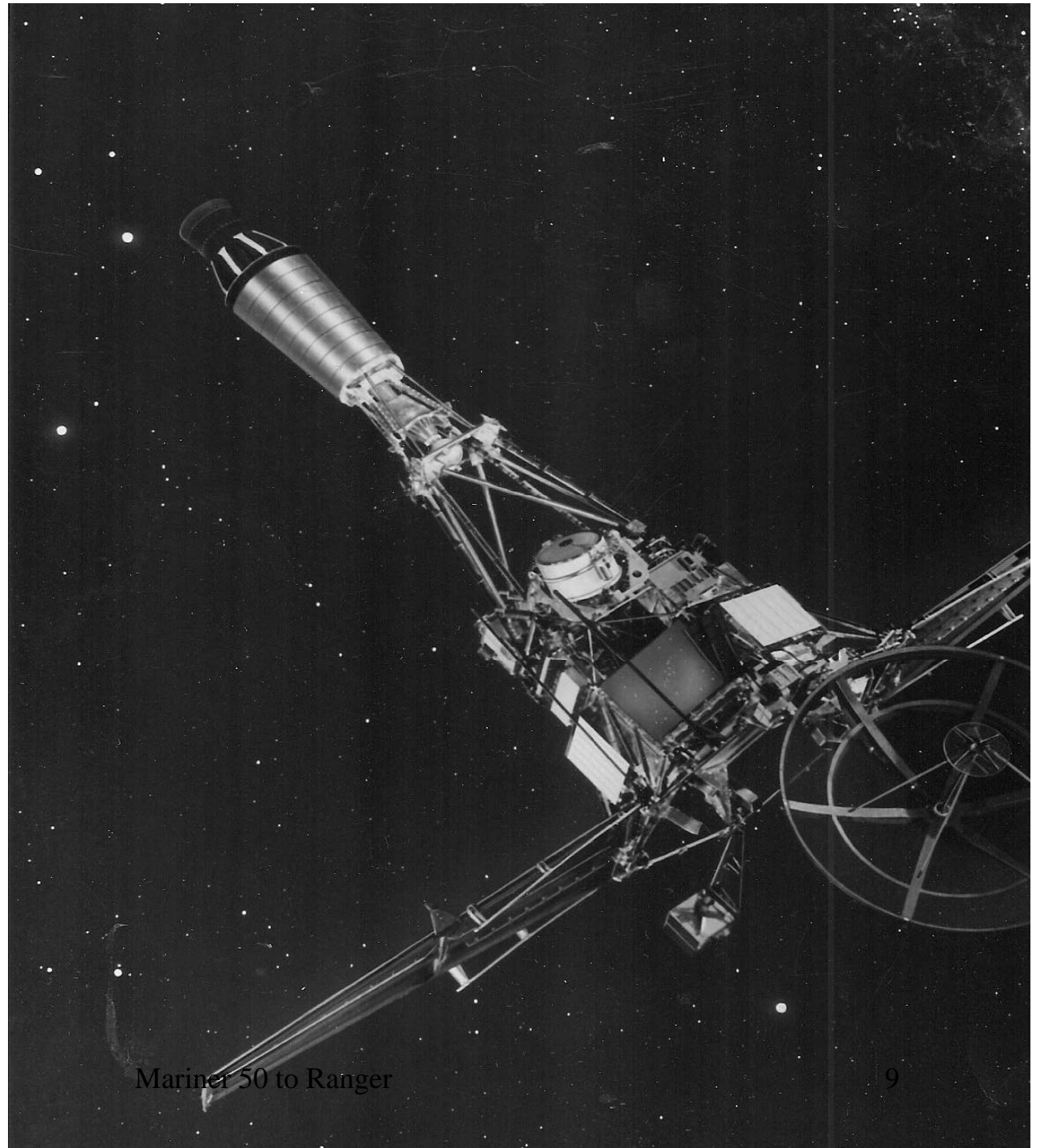
Early Ranger Mgmt. Troubles

- What upper stage to use on Atlas?
- Army (ABMA, VB team, JPL) vs. USAF habits
- Transfer from Army to NASA:
 - --- Role of MSFC
 - --- JPL resistance to new, intrusive direction
- Role of scientists (lunar OK; non-lunar a source of friction)
- Tight schedule (JPL) vs best science (Science advisors and NASA)

Ranger Payloads

- RA-1 and 2: Particles and fields instruments plus UV telescope to view Earth's hydrogen corona
- RA-3,4,5: Seismometer in rough-landing capsule; Gamma-ray spectrometer and TV on bus
- RA-6-9: Six TV cameras

RA-1 & 2

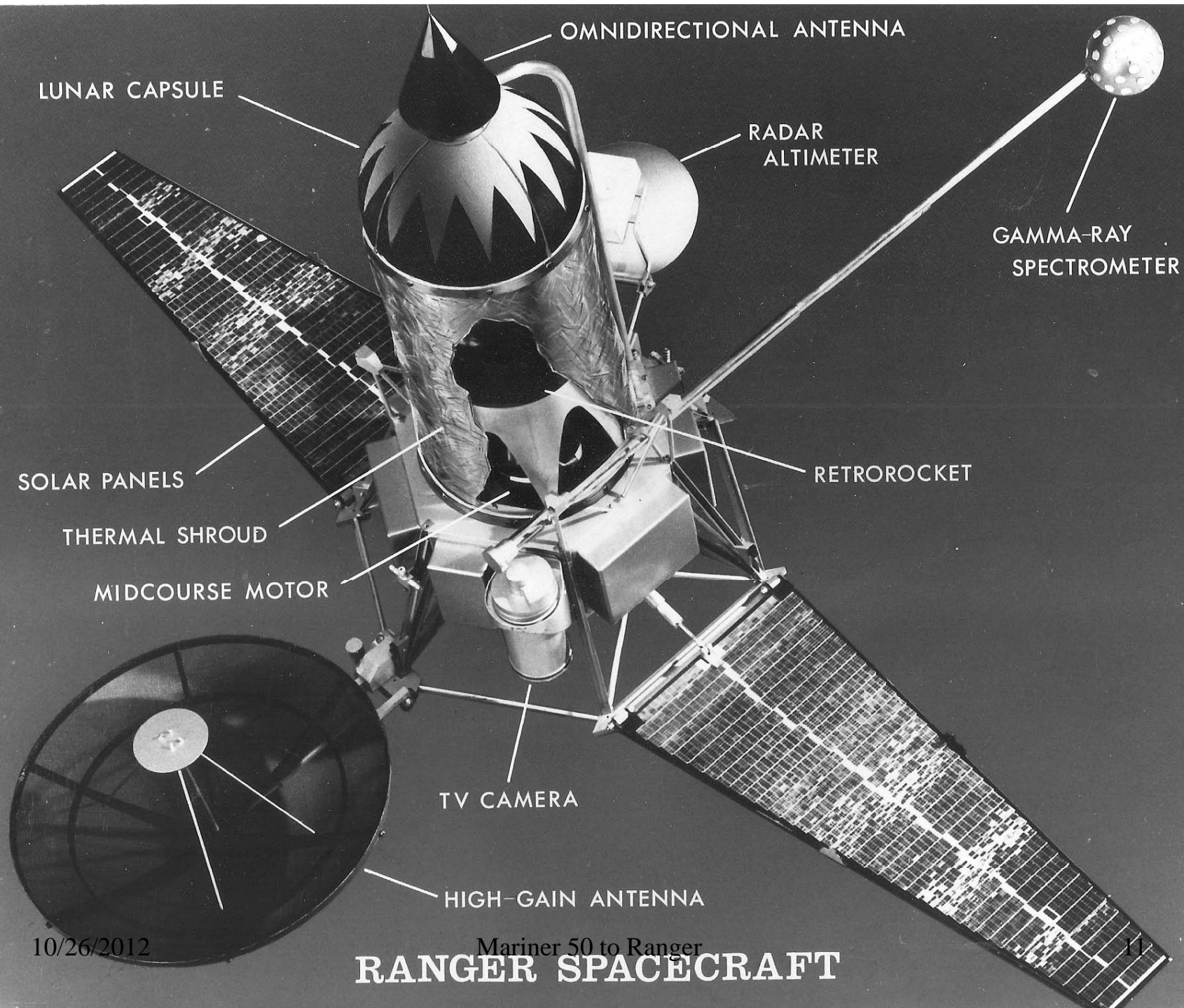


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Mariner 5 to Ranger

Ranger Flights

- RA-1: No Agena second burn; switch overheat; spacecraft OK but no science
- RA-2: Agena launched with gyros inop.
- RA-3: Mirror image m/c, missed Moon
- RA-4: Main pwr. short at Agena separation
- RA-5: Main pwr. lost; 10-32 screw overheat
- RA-6: Plasma short circuit in Agena umbilical at Atlas staging; TV burnout
- RA-7,8,9: Complete success



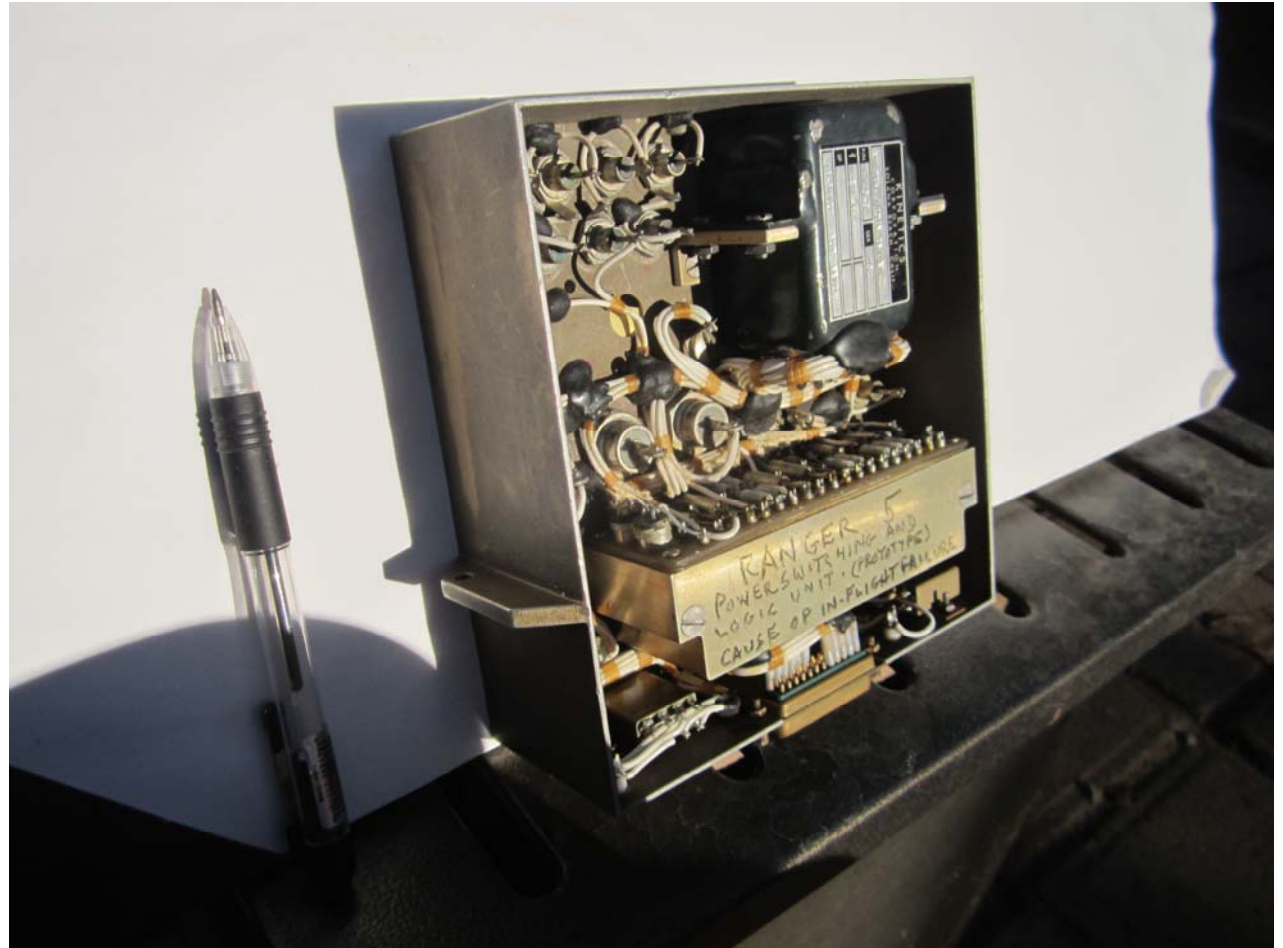
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Mariner 50 to Ranger
RANGER SPACECRAFT

11

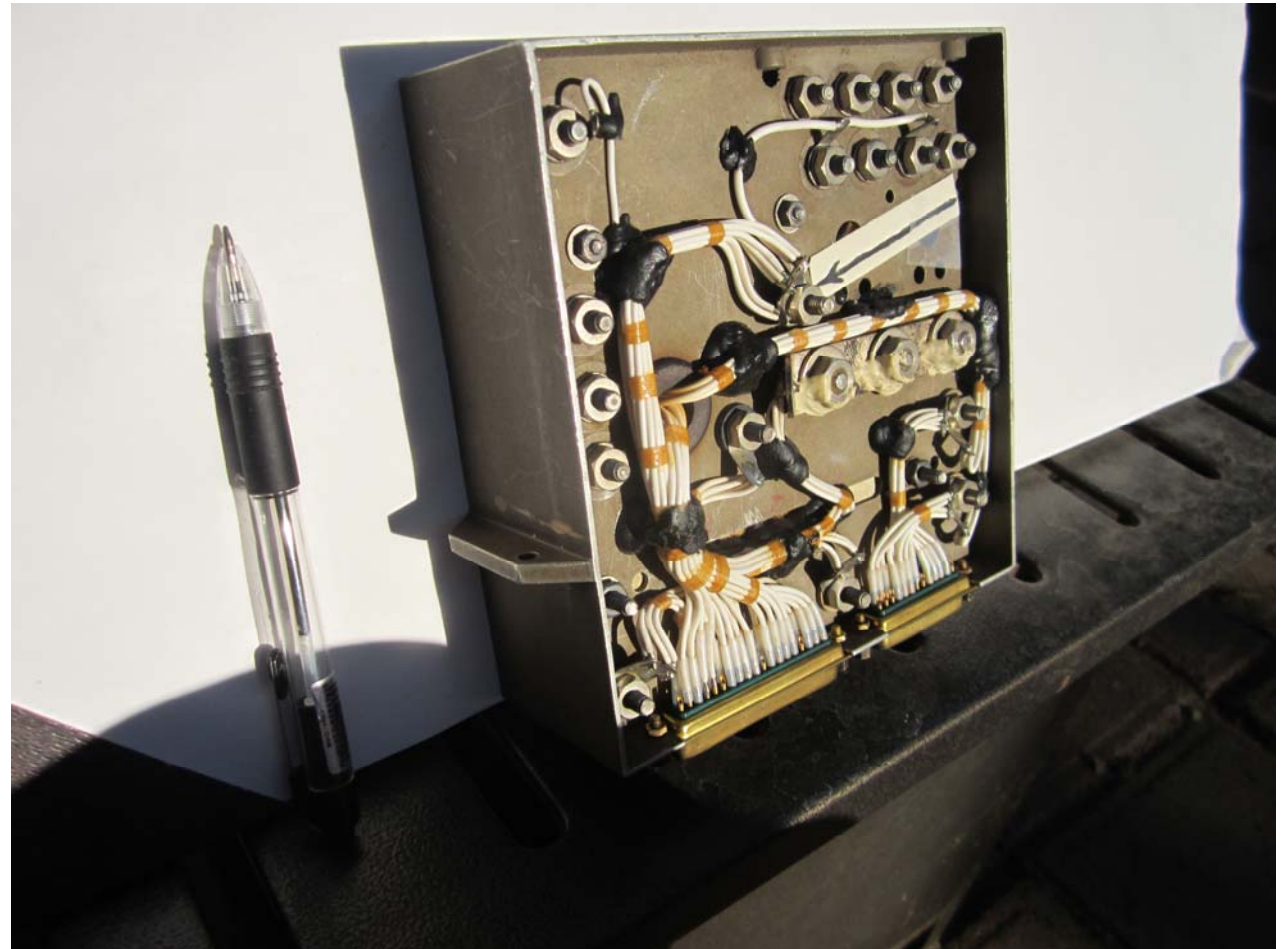
Ranger 5 Main Power Logic Unit

- Front side showing relays and distribution wiring



The Screw That Ended RA-5

- RA-5 main power logic unit; feed-thorough screw loosened, adding resistance and heat; gradually main power was lost



RA-6,7,8,9



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Mariner 5 to Ranger

14

Ranger Lessons

- Robotic deep-space exploration demands great attention to risk, and even then, both US and USSR have lost Mars missions into the 1990's
- Technical risks tend to arise at interfaces difficult or impossible to test
- Management risks, abundant in the early Ranger years, have been successfully overcome, but continued vigilance is essential
- Political intervention did not help, as it usually did not address the real causes of failure

Ranger Project References

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